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PRELIMINARY INVESTIGATION OF MUNICIPAL AND INDUSTRIAL WATER SUPPLY AND STREAM QUALITY CONTROL REQUIREMENTS AND BENEFITS ASSOCIATED WITH MULTIPLE-PURPOSE STUDIES OF THE PROPOSED DAYTON RESERVOIR, TOUCHET DIVISION, WALLA WALLA PROJECT, WASHINGTON

Public Health Service
Portland, Oregon

January 1962

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WORKING PAPER NO. 20

COLUMBIA RIVER BASIN PROJECT
For Water Supply and Water Quality Management

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DATE: January 1962

Prepared by _____

Reviewed by _____

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Region IX

Division of Water Supply and Pollution Control
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Portland 5, Oregon

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REPORT ON TOUCHET RIVER BASIN STUDIES

Preliminary Investigation of Municipal and Industrial Water Supply and Stream Quality Control Requirements and Benefits Associated with Multiple-Purpose Studies of the Proposed Dayton Reservoir, Touchet Division, Walla Walla Project, Washington

Prepared at the Request of and
in Cooperation with the Area Engineer,
Upper Columbia Development Office,
Bureau of Reclamation, Spokane, Washington

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Public Health Service
Water Supply and Pollution Control Program, Pacific Northwest
Region IX, Portland, Oregon

January 1962

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This investigation and study was aided materially by officials of the City of Dayton, Washington, Washington State Pollution Control Commission, Washington State Department of Health, Bureau of Reclamation, and the U. S. Geological Survey. Information furnished in the references listed below is also acknowledged.

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INTRODUCTION

This report represents a preliminary examination of present and future municipal and industrial water supply and stream quality control needs in the Touchet River Basin with particular reference to the feasibility of providing storage and/or flow regulation to serve these needs in the Bureau of Reclamation's proposed Dayton Reservoir of the Touchet Division, Walla Walla Project, Washington.

Request for the investigation and report was made by the U. S. Department of the Interior, Bureau of Reclamation, Upper Columbia Development Office, Spokane, Washington by letter dated August 22, 1961 asking for assistance in carrying out provisions set forth in the Water Supply Act of 1958 (Title III, P.L. 500, 85th Congress) for implementation of water supply programs and for an evaluation of needs, release schedules and benefits applicable to flow regulation for control of stream quality as provided in the Federal Water Pollution Control Act Amendments of 1961.

The report identifies uses and sources of water in the proposed project area and describes sources of waste, waste treatment practices and the effect of waste effluents and other materials on the quality of specific reaches of the Touchet River.

Included also is a preliminary economic evaluation of the project area, the findings of which form the basis for the projected municipal and industrial water demands and waste and land use effects on stream quality presented.

Since this investigation has been made in advance of study schedules planned for establishment of a Comprehensive Water Supply and Water Quality Control Program for the Columbia River Basin, certain materials presented must necessarily await later confirmation.

It is believed, however, that the needs for municipal and industrial water supply as described, the low flow releases for quality control indicated, and allied benefits as given, possess a degree of finality suitable for preliminary project planning and use in determining project feasibilities and justification.

SUMMARY

1. The period of analyses for which project benefits for municipal and industrial water supply and regulation for quality control are desired is the 100-year period 1960-2060.

2. In recent years the City of Dayton has developed both surface and ground water sources to meet demands for municipal and industrial water supply, some of which has been accomplished on a temporary basis.

3. The City of Dayton has expressed a desire to obtain their total supply from surface waters of the Touchet River and has requested consideration of storage space in the proposed Bureau of Reclamation Dayton Reservoir to provide this supply.

4. Present demands for M&I water supply at Dayton exceed firm surface water rights by about 3.0 million gallons per day (MGD) during the summer months.

5. With the increased population and industrial growth expected in the Dayton area, the summer demands for M&I water supply will exceed firm supplies available from surface water rights by 4.7 and 7.0 MGD, respectively, for the years 2010 and 2060.

6. The average M&I demand for water at the midpoint in the 100-year period of analyses is 5.7 MGD during the April-September period or 3200 acre-feet. To meet this requirement from surface water by diversion from the East Fork, the City is assured of 560 acre-feet from

the early adjudicated right of 1.0 MGD and about 170 acre-feet each spring from their late right dated 1939. This leaves a requirement of about 2470 acre-feet to be obtained through the Bureau of Reclamation storage project by a storage allocation of 1900 acre-feet of the proposed Dayton Reservoir space.

7. Stream flow requirements to receive residual waste and land drainage materials and to meet minimum stream quality objectives (acceptable by the Washington State Pollution Control Commission) in the Dayton reach of the Touchet River for the years 1960, 2010, and 2060 are estimated to be 53, 75 and 110 cfs, respectively.

8. Stream flow requirements to receive residual waste and land drainage materials and to meet minimum stream quality objectives in the Waitsburg reach of the Touchet River for the years 1960, 2010, and 2060 are 36.5, 51.5, and 86.5 cfs, respectively.

CONCLUSIONS

1. The benefit assignable to the proposed Dayton Reservoir for supplemental M&I supply based on 1900 acre-feet of active and 200 acre-feet of dead storage at the alternate site on the East Fork Touchet River is $61,500 annually.

2. The benefit assignable to the proposed Dayton Reservoir for quality control based on supplemental releases associated with 7600 acre-feet of storage at the alternate site on Wolf Creek is $94,600 annually.

3. In view of the multiplicity of beneficiaries and extent of local participation included in the achievement of water quality goals in this region, benefits attributable to provisions for water quality control as a project function are believed to be of public interest and, therefore, may be regarded as widespread and national in scope.

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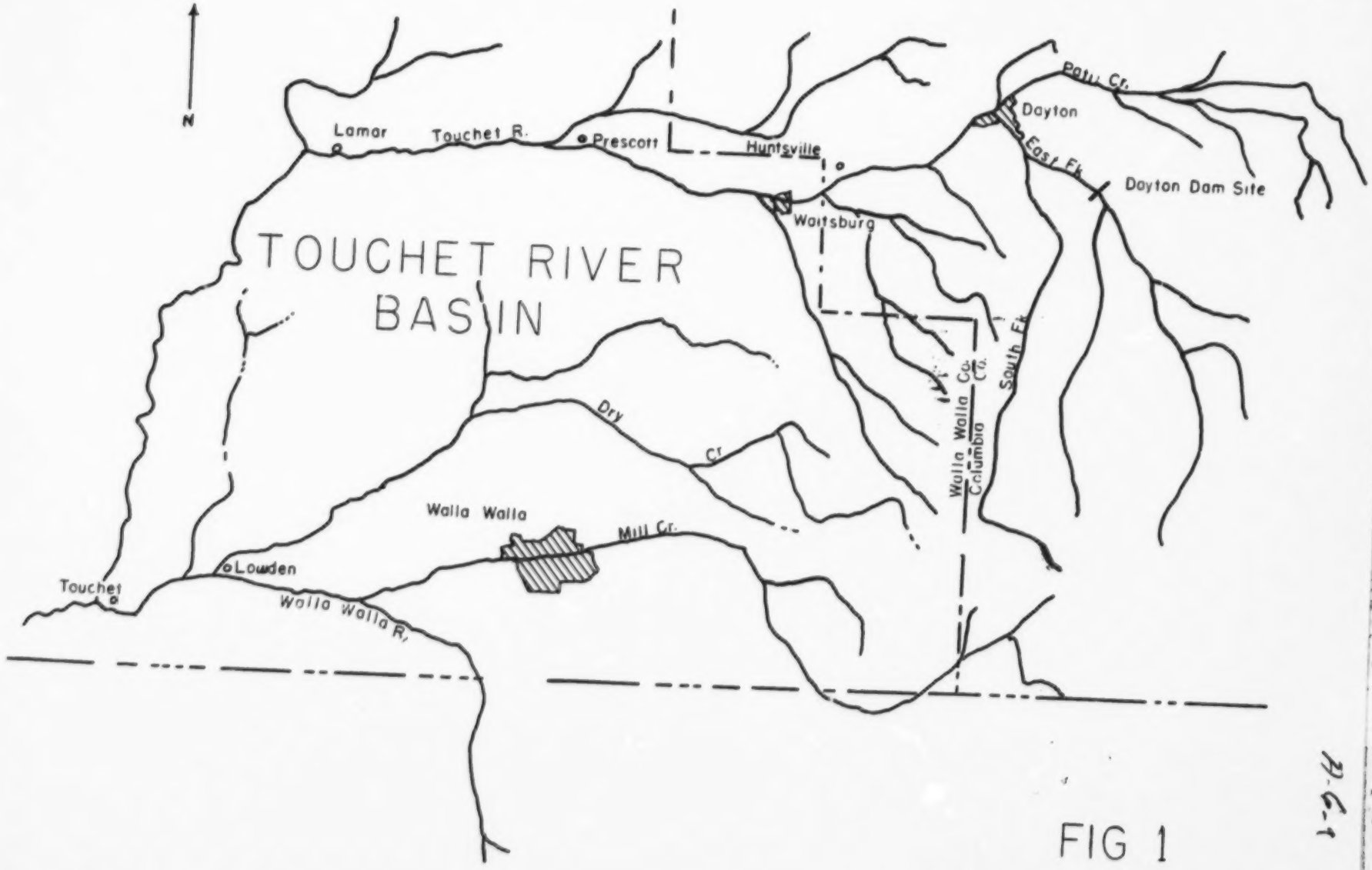

N
Lamar
Touchet R.
Prescott
Huntsville
Patit Cr.
Dayton
East Fk
Dayton Dam Site
Waitsburg
TOUCHET RIVER
BASIN
South Fk
Walla Walla Co.
Columbia Co.
Dry
Cr.
Walla Walla
Mill Cr.
Lowden
Touchet
Walla Walla R.

FIG 1

B-G-1

DESCRIPTION OF REGION AND PROJECT

GENERAL

The Touchet River is one of several systems which drains the western slope of the Blue Mountains in Southeastern Washington. The total length of the river is 76 miles originating on the west slope of the Blue Mountains at an elevation of 5870 feet and flowing to the Walla Walla River (elevation 440 feet) about 25 miles upstream from where the Walla Walla River flows to the Columbia River.

From its point of origin, the Touchet River flows westerly for about 60 miles to Lamar, Washington, thence south 16 miles to the Walla Walla River near Touchet, Washington. Major tributaries to the Touchet River are the East Fork, Wolf Creek, and South Fork which form the headwaters on Huckleberry Mountain. In all, the Touchet River system drains an area of about 750 square miles. (See Figure 1.)

The upper Touchet River Basin comprises about 40 percent of Columbia County with the middle and lower portion comprising a part of Walla Walla County. Most of the upper area is characterized by steep-sided erosional valleys which widen in lower areas to widths varying between one-half and one mile. The flow of the Touchet River is characterized throughout most of its length by riffles and long pool areas. At low stages the travel of the river flow is estimated to be between one and one and one-half miles per hour.

HYDROLOGY

Stream discharge records are available for three points along the Touchet River System. The location of these gauging stations and recorded averages and extremes for each are given below.

Gauging Station	Drainage Area ($Mi.^2$)	Avg. (cfs)	Max. (cfs)	Min. (cfs)
East Fk. Touchet R. (Dayton) (1941-51, 1956-59)	102	125	1,530	27(1)
Touchet R., Bolles (1924-29, 1951-59)	372	223	4,470	1.4(2)
Touchet R., Touchet (April 1941 to Sept. 1955)	733	242	13,300	6(3)

(1) Small municipal and irrigation diversions

(2) Numerous small diversions and diurnal effect

(3) Many small diversions

Precipitation is heaviest in the Touchet River Basin area during the winter months. From lower to upper basin, the normal annual precipitation differs by 15 inches (8 inches near Touchet and 23 inches above Dayton). During the summer months, the river flow is maintained almost exclusively by residual drainage from the headwaters area.

ECONOMIC BASE

Agriculture, allied agricultural services and processed agricultural products constitute the major sources of income to the region. Major crops are peas, asparagus and dry-farmed grains.

POPULATIONS AND DEVELOPMENT CENTERS

The largest urban development in the area is at Dayton, Washington (Columbia County) where approximately 3000 persons reside. The next largest center is Waitsburg, Washington (Walla Walla County) located 10 miles downstream from Dayton with a population of 1500. Development centers downstream from Waitsburg are Prescott, Washington (population 250), Lamar, Washington (railroad siding only), and Touchet, Washington (population over 600) located near the mouth of the Touchet River.

The City of Walla Walla (population 25,000), the largest city in Southeastern Washington, is 20 miles south of Waitsburg and 30 miles southwest of Dayton. Industrial development in the Touchet River Basin is confined to the Dayton and Waitsburg area.

PROPOSED RESERVOIR

The site of the proposed Dayton Reservoir is on the East Fork Touchet River about four miles above Dayton. The plan at the present time involves storage for irrigation, flood control, fish and wildlife, municipal and industrial water supply, quality control, and recreation.

No provisions are to be made in the project for distribution of irrigation water; however, construction of project drainage for protecting lower level lands and assisting in the development of return flow are tentatively planned to be constructed as the needs occur. Landowners

would pump directly from the river by use of private systems. A portion of the reservoir storage space may be reserved for development of irrigation on lands outside the Touchet River Basin at a later date.

Provisions will be made to transport anadromous fish over the dam to allow reaching spawning grounds upstream from the reservoir. As tentatively planned, downstream fish migration from the reservoir would be through a multi-gated outlet works. A minimum of 30 cubic feet per second below the dam, past all diversions, and out the mouth of the river, would be provided for transportation, propagation and enhancement of fish life.

STUDY OBJECTIVES AND PROCEDURES

The objective of this study and report is to establish, by use of existing and projected data, preliminary conclusions on the feasibility of providing in the Touchet Division Project, storage space for municipal and industrial water supply and storage and/or flow regulation for stream quality control and to enumerate where practicable the benefits that would accrue to the project with these purposes included.

Existing sources of municipal and industrial supply are examined and with projected demand data, the adequacy or suitability of these sources in meeting future demands is estimated. Where warranted, alternate supplies to either replace or supplement rights or developed sources are identified and explanations are given on procedures to be followed for determining whether use of the Federal project, in lieu of other development possibilities, would be feasible or justified and if so, on what basis benefits may be derived.

Where it is estimated that developed sources or water rights would not adequately meet projected demands or that quality would limit continued use of these supplies, such information is indicated.

Stream flow requirements for quality control are based on specific quality parameters to be controlled and objectives to be achieved as governed by the beneficial uses enumerated and the particular

quality required to satisfy these uses. Whereas flow regulation for quality control is regarded only as a supplement to waste treatment or other measures of control at the source, computations involving needs for waste assimilation and dilution in the stream reflect prior provisions for such treatment or control. Should the quality of irrigation return flows be suspected of contributing significantly to reduced stream quality, i.e., nutrient or mineral enrichment, toxicity, turbidity, bio-chemical oxygen demand, etc., a statement to this effect is made with an explanation of the intent of the Public Health Service to conduct studies and surveys at a later date on which to base recommendation for possible further means of control.

Whereas flow regulation requirements for the control of quality incorporate a reasonable degree of waste treatment for achievement of this control, the alternate method and hence, the benefit assignable to such regulation is considered to be the equivalent of costs to construct, operate and maintain the least costly single-purpose alternate impoundment structure designed to accomplish the improvement. Although, for example, waste distillation or underground disposal would accomplish similar improvements, these methods are not considered to be feasible or equivalent alternates. Annual benefits assignable to project regulation for quality control, therefore, would be based on amortized costs plus annual operation and maintenance expenses involved in achieving similar regulation by the single-purpose impoundment and release method.

PRELIMINARY ECONOMIC REPORT AND ESTIMATE OF GROWTH, 1960-2060

INTRODUCTION

Purpose of Analysis

This analysis is intended to provide a preliminary estimate of the economic potentials and anticipated growth of the subject area.

Definition of Area

The Touchet River Area is in southeast Washington. It includes a major part of Columbia County and a broad corridor, adjoining the Touchet River and the Walla Walla River below its juncture with the Touchet River, through Walla Walla County. For the purposes of this preliminary estimate, it has been approximately defined by Census Divisions as shown in Table 1. Excluded from the projections are the areas on the shores of the Columbia River at the mouth of the Walla Walla River.

Study Period

The study period is the 100-year period ending in 2060. The year 2010 is taken as an interim point.

Limitations of Analysis

This analysis is intended only as an initial estimate of the outlook of the Touchet River Area, based upon broad trends. Subsequently, in connection with the development of the Columbia River Basin Project for Water Supply and Water Quality Management, additional and more detailed economic analysis will be considered. Such an analysis

would include studies of growth potential on an industry-by-industry basis. At that time, this preliminary estimate will be reviewed and revised if necessary.

Present Economic Development

Population

The Touchet River Area contained about 8000 persons in 1960. This represented a loss of more than 2% in the decade 1950-1960. This population was about evenly distributed between the Columbia County and Walla Walla County portions of the area. The largest community was Dayton with a population of about 3000 persons. The population of the area and its distribution for both 1950 and 1960 is shown in Table I.

Table I. Population in Touchet River Area, 1950 and 1960
Source: U.S. Census of Population, 1960
/Final Report PC(1)-49A/

	Number of Inhabitants	
	1950	1960
Columbia County:		
Division 1	1372	1213
Dayton City	2979	2913
Division 3	244	221
Upper Touchet River	4595	4347
Walla Walla County:		
Prescott Town (in Div.1)	244	269
Half of Remainder of Div. 1	331	331
Half of Division 2	88	76
Half of Division 3	442	543
Division 4	804	779
Half of Division 5	260	253
Waitsburg City (in Div. 6)	1015	1010
Half of Remainder of Div. 6	450	432
Lower Touchet River	3634	3693
Total Study Area	8229	8040
Decrease in Population	189	
Decrease as % of 1950	2.3%	

The population of the Study Area is compared to certain other areas in Table II. It should be noted that the population trend of the Study Area is considerably different from the State and the Nation. The growth of Walla Walla County is mainly attributed to population increases in Walla Walla City and its suburbs.

Table II
Population Growth of Touchet River Area
Compared to Selected Areas

Source: U. S. Census of Population, 1960

	Number of Inhabitants 1950	1960	Percent Change 1950 to 1960
Columbia County	4,860	4,569	- 6.0%
Upper Touchet River Area	4,595	4,347	- 5.4%
Upper River Area as % of County	(94.5%)	(95.0%)	---
Walla Walla County	40,135	42,195	5.1%
Lower Touchet River Area	3,634	3,693	1.7%
Lower River Area as % of County	(9.0%)	(8.7%)	---
Washington State	2,378,963	2,853,214	19.9%
Touchet River Area	8,229	8,040	- 2.3%
Touchet River Area as % of State	(0.35%)	(0.28%)	---
United States	151,325,798	179,323,175	18.5%

Industrial Pattern

(General)

For the purposes of this estimate, it is considered reasonable to examine the industrial pattern of Columbia County and to assume that it is representative of the portion of the Walla Walla County area which is included in the Study Area.

The 1950 distribution of employment in Columbia County is shown in Table III. This table illustrates the importance of agriculture as a major basic industry in the area. This importance is emphasized even more by analyzing the composition of the manufacturing employment. The major component of manufacturing employment is due to food processing industries.

Table III
Distribution of Employment
in Columbia County, Washington in 1950

Source: U. S. Census of Population, 1950

	Employed Persons	
	Number	% of Total
Agriculture	644	36.8
Manufacturing	204	11.7
Retail Trade	249	14.3
Other (Mainly service industries)	652	37.2
Total	1749	100.0

A comparison of 1950 Census of Population data with the 1959 Census of Agriculture and with 1960 "Covered Employment" data from the Washington State Department of Employment Security indicates that the 1950 pattern is still substantially correct for the Study Area. Unfortunately, the "economic characteristics" sections of the 1960 Census of Population have not yet been made available.

(Manufacturing)

The main manufacturing plants on the Touchet River are at Dayton and Waitsburg. They are both owned by the Green Giant Company and

are briefly described in the following tabulation 1/:

Location:	Dayton	Waitsburg
Product:	Canned peas, asparagus	Canned peas
Average employment:	100-249	20-49
Peak employment:	1000-2499	250-499

1/ Data are from the "1961 Directory of Washington State Manufacturers," Washington State Department of Commerce and Economic Development.

The output from these two plants has been estimated to be about 1-3/4 million cases of peas and 180,000 cases of asparagus annually. This estimate is based on a 1959 production statistic for the company's Blue Mountain Division, proportioned in accordance with employment.

From an examination of Columbia County "Covered Employment" in non-durable goods manufacturing for 1960, it appears that the peak of canning operations occurs during May, June and July. The employment in this category during these months was four times greater than during the remaining months of the year.

(Agriculture)

Using as a guide for the Study Area the Columbia County statistics from the 1959 Census of Agriculture, it is seen that the number of farms has been decreasing, but their average size has been increasing since 1954. About three-fourths of the cropland harvested was in grain crop production, with green peas and asparagus accounting for the majority of the remaining cropland harvested.

Irrigation is practiced on a relatively small amount of the area's land. Columbia County in 1959 reported 3,343 acres irrigated, compared to 114,656 cropland acres harvested. Walla Walla County had considerably more irrigation (37,296 acres irrigated and 279,538 acres of cropland harvested) but much of this is outside the Study Area. The Touchet Division, as presently envisioned by the Bureau of Reclamation, would include irrigation of 9,960 acres in the Touchet River valley, 4,490 acres of which now have an inadequate supply. The proposed reservoir would include unassigned space for future irrigation of from 5,000 to 7,000 acres, some of which would be outside the Touchet River valley.

Estimated Growth

Possibilities for Growth

Three possibilities for growth in the Study Area can be predicted at this time. They are (1) a moderate increase in service industries due to automobile traffic on the proposed Lolo Pass Highway, (2) a possible increase in population merely due to the pressure from other areas, and (3) a moderate increase in population and service industries due to the proposed Dayton Project. This project would not only increase the value of farm output, but would have some other income-generating aspects through the use of the proposed reservoir for its various multiple purposes.

Estimate of Future Growth

For the purposes of this study, the maximum estimate of future population growth is based on an assumed growth rate of 0.5% a year. This is the same annual rate as Walla Walla County experienced in the 1950-1960 decade, but is only about a fourth as large a rate as the State's growth during the past decade. As a minimum estimate of population growth, it is assumed that no change will occur. This is in contrast to the past decade during which there was a net loss. Based on these growth rates, the number of inhabitants in the Study Area is estimated to increase as shown in Table IV. The distribution of the increase is expected to remain about the same as at present, with 50% rural and 50% in urban places.

Table IV
Estimate of Future Population Growth
in Touchet River Area, 1960 to 1980-2010-2060

	Number of Inhabitants	
	Maximum	Minimum
1960	8,040	8,040
Annual Growth Rate	0.5%	none
1980	8,900	8,040
2010	10,300	8,040
2060	13,200	8,040

It is not deemed reasonable under the conditions of this study to forecast in greater detail the increases in industrial or commercial development. No specific large industrial expansion is foreseen. The growth of existing industry and commerce is expected generally to keep pace with the forecast for population growth.

PRESENT WATER SUPPLY

At the present time, the major uses of water for municipal and industrial purposes in the Touchet River Basin exist at Dayton and Waitsburg.

Dayton

The City of Dayton obtains most of its water supply through a 3.3 mile-long supply line diverting from the East Fork Touchet River. Water can be diverted to the filtration plant from the river at the City's diversion dam and/or a shallow gravity well located near the river and flows by gravity into the City's distribution system and equalizing reservoirs. By gravity flow, the main supply line is limited to about 1.6 MGD; with a booster pump installed in 1960 on the pipeline the capacity is about 2.0 MGD. The water supply obtainable by gravity is supplemented during summer months of high demand by pumping from a 1,250-foot well which was drilled in 1936. The well yields 768 GPM (1.1 MGD) and is used nearly continuously three or four months each summer. The Green Giant Company obtains some of its water from the city and in addition has a 942-foot deep well of its own capable of producing 680 GPM (1.0 MGD).

Only until recently, as a result of metering the city well supply, has it been possible to accurately determine the total water use in the Dayton area. Following is an estimate of average daily demands occurring during the heavy use months of April through July:

Demand	MGD
Municipal System	
Domestic and commercial	1.7
Parks, cemeteries, etc.	0.4
Industrial	1.1
Industrial well	0.8
Total	4.0

The City's system plus the industrial well are sufficient to meet demands, but surface water rights to meet the added requirements in the past 25 years are subject to prior rights downstream.

The City of Dayton holds a decreed Class 2 right (priority date 1864) to 1.0 MGD of surface water which is applicable to use at their diversion dam and/or gravity well. This right is one of the earliest on the river and is entitled to natural flow throughout the year. The City also holds a surface water right for 0.6 MGD, but its late priority date of 1939 entitles the City to divert only during periods of high stream flow during spring months. Consequently, during summer months of high demand storage water is needed to allow the City to exercise this and any other later surface water rights needed to meet future demands. The City also holds title to ground water rights of 1.0 MGD from their deep well (1936) and 0.4 MGD (1959) from a sump within the City which is not used at this location, but equivalent amounts are being diverted from the river on a temporary basis.

The City of Dayton is desirous of obtaining all their water supply by gravity diversion from the river and has asked the Bureau of Reclamation to determine the cost of firming up their surface water supply for both present and future needs by storage in the proposed Dayton Reservoir.

Waitsburg

The community of Waitsburg obtains its supply from Coppei Creek with chlorination supplemented by wells during part of the year. The total yield of developed well supplies in this area (private and public) is estimated to be about 2700 gpm, of which 1000 gpm is available from the city wells to meet municipal and industrial (cannery) demands. During peak summer demand periods, essentially the full yield of the city well is pumped. It is estimated, however, that the normal summer demands at Waitsburg, including industrial requirements, utilize about 70 percent of the total yield of this supply.

RAW WATER QUALITY

According to standards of quality usually recommended for domestic supply, ground water in the Dayton and Waitsburg area appears suitable for domestic use without treatment. Following are quality data and corresponding recommended standards relative to specific quality parameters available on ground water in the Dayton-Waitsburg area.

Ground Water Analysis (1)

Quality Parameter	Dayton, Wn. (ppm) 1250 ft.	80 ft.	Recommended Standard (ppm)
Silica (SiO_2)	52	48	
Iron (Fe)	0.02	0.05	0.3
Calcium (Ca)	27	16	-
Magnesium (Mg)	10	7.3	125
Sodium (Na)	8.8	5.4	-
Potassium (K)	2.2	3.5	-
Bicarbonate (HCO_3)	148	88	120
Carbonate (CO_3)	0	0	-
Sulfate (SO_4)	2.2	3.5	250

Ground Water Analysis (1)
(Continued)

Quality Parameter	Dayton, Wn. (ppm) 1250 ft.	80 ft.	Recommended Standard (ppm)
Chloride (Cl)	2.5	3.5	250
Fluoride (F)	0.3	0.2	1.0
Nitrate (NO_3)	2.1	8.6	45
Phosphate (PO_4)	0.3	0.38	-
Dissolved solids	130	139	500
Hardness as $CaCO_3$	110	75	150-200 (2)
pH (3)	(7.6,7.7)	(7.2,7.3)	-
Color (4)	(5)	(0)	(15)

(1) Courtesy of U. S. Geological Survey
(2) By common practice
(3) Logarithum of reciprocal of hydrogen-ion concentration
(4) Platinum-cobalt-scale (units)

Data on the quality of surface water at the confluence of the East and South Forks of the Touchet River are given below.

Quality Parameter	Touchet River (1) Avg. (12 samples) 1959-60 (ppm)	Recommended Standard (ppm)
Silica (SiO_2)	31	-
Iron (Fe)	0.3 (2)	0.3
Calcium (Ca)	7.5	-
Magnesium (Mg)	2.5	125
Sodium (Na)	2.6	-
Potassium (K)	1.8	-
Bicarbonate (HCO_3)	43.5	120
Carbonate (CO_3)	0	-
Sulfate (SO_4)	1.13	250
Chloride (Cl)	0.35	250
Fluoride (F)	0.12	1.0
Nitrate (NO_3)	0.31	45
Phosphate (PO_4)	0.09	-
Dissolved Solids	76	500
Hardness as $CaCO_3$	29	150-200
pH (3)	(7.0-8.3)	-
Color (4)	(10)	(15)

(1)Courtesy State of Washington, Quality of Surface Waters, June 1959-July 1960
(2)Does not include one sample - 3.2 ppm.
(3)Logarithum of the reciprocal of hydrogen-ion concentration
(4)Platinum-cobalt-scale (units)

FUTURE WATER SUPPLY

Because past trends have indicated increasing demands for municipal and industrial water in the Dayton area, it is assumed that throughout the next 100 years additional increases will occur. The extent to which future demands are estimated to increase are therefore based on the maximum population and industrial growth estimated (minimum estimate - no change) in the preceding preliminary economic study.

Of the total increase in population expected in the Touchet River Area (population increase of 2260 by 2010 and 5160 by 2060), 50 percent are expected to locate at Dayton with only a very slight increase expected at Waitsburg. On this basis, the only locality for which provisions for additional future supply appears warranted is the Dayton area.

At the present time, the per capita water use during the winter and intermediate seasons of the year at Dayton is about 170 gallons per day (0.5 MGD supplied from the gravity well without need for the filter plant supply). By the years 2010 and 2060 an additional demand of 0.3 MGD and 0.6 MGD, respectively (@ 200 gpcd and population of 4130 and 5580, respectively) could be expected during these times of year. Operation of the filter plant would be required to meet these additional winter and intermediate seasonal demands; however, surface water rights and quantities of water available would not be exceeded.

It is apparent, therefore, that the major concern at Dayton is to assure a continuously adequate supplemental supply during the dry growing season and periods of usage for food processing. Whereas at the present time, the canning season occurs between April and July, the introduction of special crops to the area as promoted by the proposed project may necessitate extension of the canning season. With this as a possibility, it could be expected that future industrial demands would occur throughout the period of April through September.

Because of the relatively large per capita summertime use of water at Dayton (700 gpcd), no appreciable future increase in this rate would be expected to occur. By allowing only for irrigation of additional or expanded parks, etc., a future per capita municipal summertime rate of 750 gpcd could be expected. On this basis, the total municipal summertime demand at Dayton exclusive of industrial demands would be 3 MGD by the year 2010 and 4.2 MGD by the year 2060.

Anticipating that industrial expansion would proceed at approximately the same rate as population growth and that periods of operation would be extended, about 100 percent more industrial water than used at the present time would be required by the year 2010 (2.7 MGD total) and 200 percent more by the year 2060 (3.8 MGD total).

Following is a summary of the demands that would arise as a result of expanded activities expected in the Dayton, Washington area.

Dayton, Washington	1960	2010	2060
Municipal Water Supply			
Population	3000	4130	5580
Oct-Mar gpcd	170	200	200
MGD	0.51	0.83	1.10
Ac.ft.	290	460	620
Apr-Sept gpcd	700	750	750
MGD	2.1	3.0	4.2
Ac.ft.	1180	1690	2360
Industrial Water Supply			
Oct-Mar MGD	None	None	None
Apr-Sept MGD	1.9*	2.7	3.8
Ac.ft.	710	1520	2140
Municipal and Industrial Water Supply - April-September			
MGD	4.0	5.7	8.0
Ac.ft	1890	3210	4500

*April-July

The distribution of M&I water requirements throughout the months of April-September based on usage in 1960 and 1961 at Dayton in percentage of the total is estimated as follows:

	Percent of Total Supplemental
April	7
May	13
June	21
July	25
August	21
September	13

In event that supplies were supplemented by use of ground water, the combined summer pumpage in the Dayton and Waitsburg area would be 5.8 MGD (3,260 acre-feet) by the year 2010 and 8 MGD (4,500 acre-feet) by the year 2060. Until it could be determined that the supply of ground water could be depended upon to yield a sustained volume of this magnitude, further development of this source in lieu of developing dependable surface water sources cannot at this time be recommended.

WATER SUPPLY BENEFITS

Having established that additional supplemental water will be required at Dayton and that impoundment of surface flows would offer, among other advantages, dependability, consistency of raw water quality and gravity advantages, it would appear that inclusion of M&I water supply in the proposed Dayton Reservoir should be considered.

According to data previously presented, the average M&I demand for water at the midpoint in the 100-year period of analyses amounts to 5.7 MGD during the April-September period, or 3,200 acre-feet. To meet this requirement from surface water by diversion from the East Fork, the city is assured of 560 acre-feet from the early adjudicated right of 1.0 MGD and about 170 acre-feet each spring from their late right dated 1939. This leaves a requirement of about 2,470 acre-feet to be obtained through the Bureau of Reclamation storage project by a storage allocation of 1,900 acre-feet of the proposed Dayton Reservoir space. Annual benefits assignable to project storage on an alternate single-purpose cost basis, therefore, would be equivalent to costs involved in providing by single-purpose means, the 1,900 acre-feet of space. Since the associated costs (conventional water treatment) would in each case be essentially the same, no deduction of these in the benefit analysis is necessary. It is recommended, however, that the City of Dayton investigate all appurtenance and costs involved in the enlargement of the treatment, transmission and distribution system.

Two alternate single-purpose impoundment projects have been evaluated by the Bureau of Reclamation for the Dayton area. Each is located on the East Fork Touchet River upstream from the existing plant intake. One site is on the East Fork immediately downstream from the mouth of Jim Creek (Site #1), and the other is on Robinson Creek above its confluence with Wolf Creek (Site #2). Each would deliver water in the open stream to the existing point of diversion. Following are the estimated costs to develop and operate these water supply impoundments.(1)

Alternates	Annual Cost (2)
Site #1	$ 61,500
Site #2	80,900

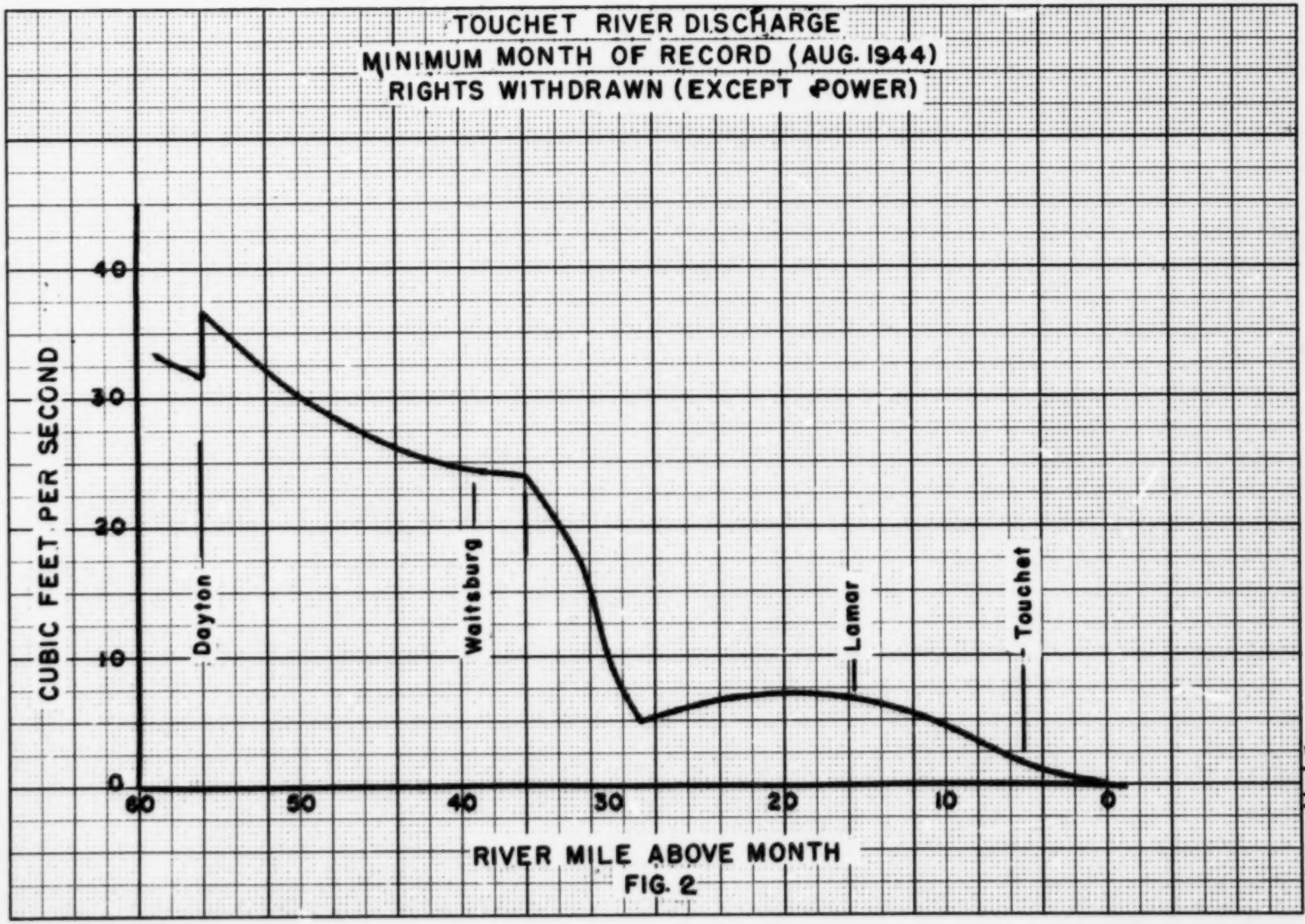
(1) Computed by Bureau of Reclamation.
(2) Annual Equivalent Cost for M&I based on 100-year analysis at 4% interest.

It is apparent by comparison of the above costs that the single-purpose site on the East Fork below the confluence of Jim Creek would most likely be developed in the absence of the proposed project. On this basis, therefore, the benefit assignable to storage space in the proposed Dayton reservoir for M&I supply would be $61,500 annually.

PRESENT WASTE SOURCES

Sources of waste in the Dayton and Waitsburg area consist mainly of domestic sewage and process wastes originating from the canning of peas and asparagus. In terms of five-day bio-chemical oxygen demand (BOD_5), raw wastes produced during the canning season, including cannery screenings, are estimated to be equivalent to raw organic wastes from a population of approximately 135,000 persons per day at Dayton and about 30,000 persons per day at Waitsburg. Treatment facilities (secondary treatment) have been provided at Dayton which remove a large percentage of the solids and bio-chemical oxygen demand contained in the domestic sewage and portions of the cannery wastes. The treated effluent is disinfected prior to discharge to the Touchet River to control pathogenic organisms. At Waitsburg domestic sewage is given intermediate treatment for solids and bio-chemical oxygen demand reduction (trickling filter and single clarifier).

Cannery wastes constitute by far the greatest source of pollution in the area. Because conventional biological treatment of these wastes has not proved satisfactory, pea canning wastes at Dayton and Waitsburg are disposed of on land. In view of the extent of treatment and other methods of waste disposal, it is estimated that oxygen demanding materials presently received in the Touchet River from treatment plant and land sources amount to approximately 15 percent of the total loads produced.


TOUCHET RIVER DISCHARGE
MINIMUM MONTH OF RECORD (AUG. 1944)
RIGHTS WITHDRAWN (EXCEPT POWER)
CUBIC FEET PER SECOND
40
30
20
10
0
Dayton
Waitsburg
Lamar
Touchet
60
50
40
30
20
10
0
RIVER MILE ABOVE MONTH
FIG. 2

E1-H

PRESENT WATER QUALITY

According to studies made by the Division of Industrial Research, Washington State University, Pullman, Washington, dissolved oxygen in the Touchet River downstream from Dayton at times approached complete depletion prior to the time that land disposal practices were introduced. Studies conducted by this Division, subsequent to land disposal at Dayton, indicate that a decided improvement has taken place in the Touchet River. With land disposal and stream flow of the order of 95 cfs, dissolved oxygen levels were controlled at about 6.5 ppm. It is apparent, however, that with reoccurrences of much lower stream flow (minimum monthly average recorded flow less than 35 cfs) much lower dissolved oxygen levels would prevail. Records show, for example, that a 30-day average sustained low flow of 14.5 cfs can occur at the mouth of the Touchet River once in ten years. With maximum withdrawals, excluding power rights, a 30-day average sustained low flow of 6.5 cfs would occur. At Dayton, however, with maximum withdrawal of rights, the 30-day average sustained low flow returning once in ten years would be 33 cfs. The following tabulation indicates to what extent minimum stream flows can be encountered at the three gaging stations along the Touchet River.

Gaging Station	Minimum Stream Discharge (cfs) Consecutive Days in 10 Years				
	1	7	14	21	30
E. Fork near Dayton					
w/o withdrawals	31	34	35	36	36
with withdrawals	28	31	32	33	33
Touchet R. Bolles					
w/o withdrawals	18	21	23	24.5	26
with withdrawals	2.6	6	8	9.5	11
Touchet R. Touchet					
w/o withdrawals	30	35	36	37	37.5
with withdrawals	0	4	5	6	6.5
U.S.G.S. records	7	12	13	14	14.5

Figure 2 shows the minimum monthly recorded discharge profile for the Touchet River with existing rights removed (excludes power rights).

QUALITY CONTROL

In view of the importance of the water resource to the economy of the Touchet River Basin and surrounding region, it is imperative that every effort be made to preserve and protect this valuable resource. Any possible means of maintaining control of water quality, whether it be to protect health, property or aesthetic values, would possess particular value to the region.

Considerable contact is made with the waters of the Touchet River. Stock are watered, water is handled for irrigation, and various points along and adjacent to the stream are accessible for public picnicking and other forms of recreation. With increased irrigation, expanded recreational activities, and the enhancement of fishing that would be promoted by the proposed project, an even greater need to control stream quality would be produced.

Municipal and industrial waste treatment and disposal practices at Dayton and Waitsburg, although quite adequate in relation to present conventional standards, provide only limited protection of the uses and values of the stream. With the extent, duration and frequency of low stream flows that occur in the Touchet River and with increasing populations and industrial activity expected in the region, stream quality would become more and more degraded. Such values as the aquatic environment and natural self-purification properties of the

stream would become increasingly affected, and nuisance conditions that could arise would become more frequent and severe.

Assuming that a reasonable degree of conventional waste treatment with effluent chlorination were maintained and that regulation of stream flows were provided in the Dayton and Waitsburg reaches of the Touchet River, considerable improvements in the quality, condition and protection of health and other values could be achieved.

Because of the seasonal nature of activities in the Dayton and Waitsburg area, and occurrence of low stream flows during the summer months when the production of pollutional material is greatest, augmentation of low flows during only this season appears necessary. The extent to which augmentation would be required and the values assignable to provisions for such regulation in the proposed Dayton reservoir, therefore, include an analysis only of the regulation required during the summer months (sufficient natural winter flows and closure of industrial activities eliminate the need for winter regulation).

In view of the particular characteristics of waste effluents produced in the Dayton and Waitsburg areas and the various uses made of the stream, low flow augmentation for the control of the dissolved oxygen resource of the stream is chosen as the governing control parameter. Without knowledge at this time of such things as the nutrient enrichment effects of return irrigation flows on the stimulation of nuisance algae and slime growths, regulation or recommendations for the specific control of

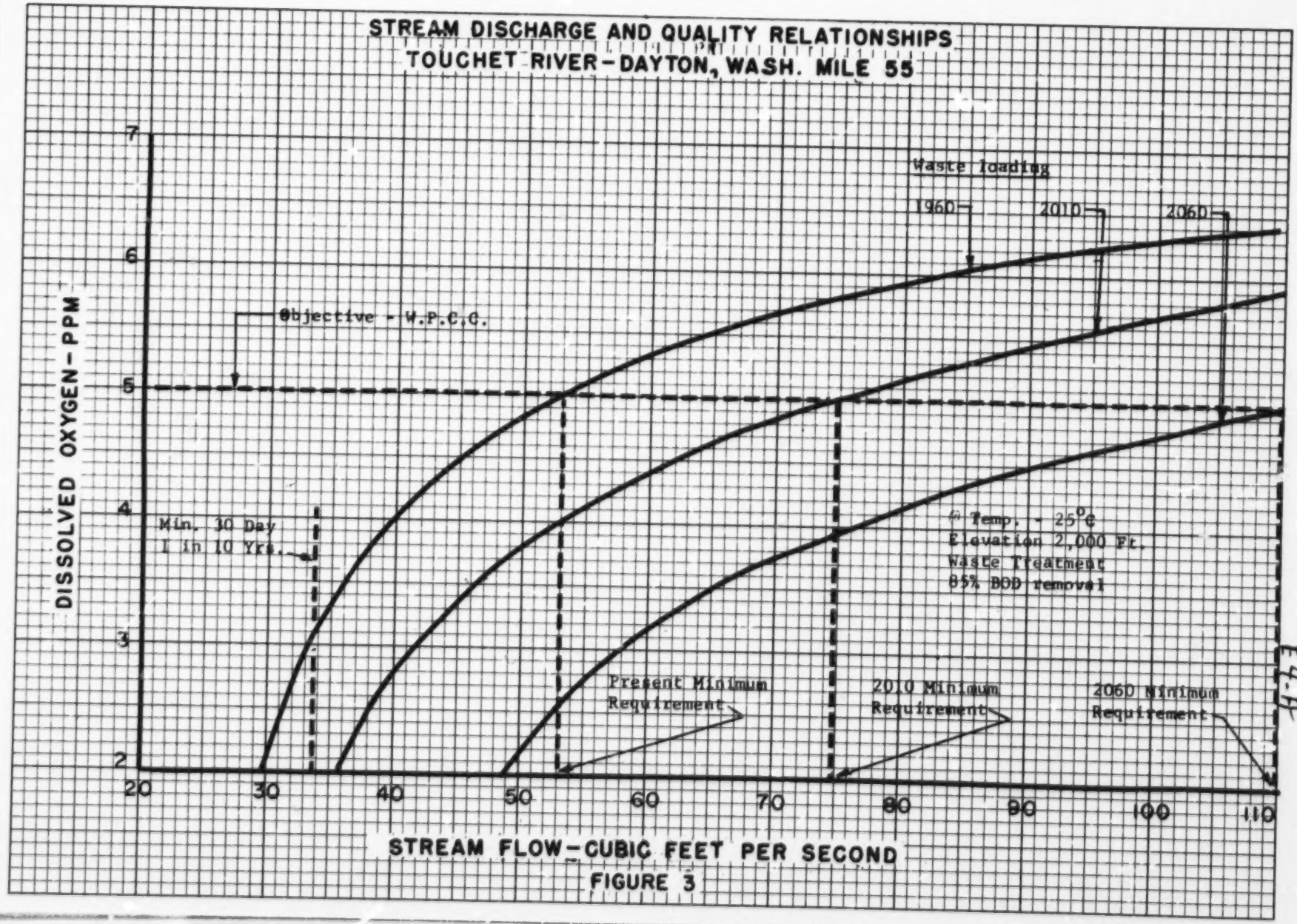

STREAM DISCHARGE AND QUALITY RELATIONSHIPS
TOUCHET RIVER - DAYTON, WASH. MILE 55
DISSOLVED OXYGEN - PPM
7
6
5
4
3
2
Waste Loading
1960
2010
2060
Objective - W.P.C.C.
Min. 30 Day
1 In 10 Yrs.
Temp. - 25°C
Elevation 2,000 Ft.
Waste Treatment
85% BOD removal
Present Minimum
Requirement
2010 Minimum
Requirement
2060 Minimum
Requirement
20
30
40
50
60
70
80
90
100
110
STREAM FLOW - CUBIC FEET PER SECOND

FIGURE 3

E4-A

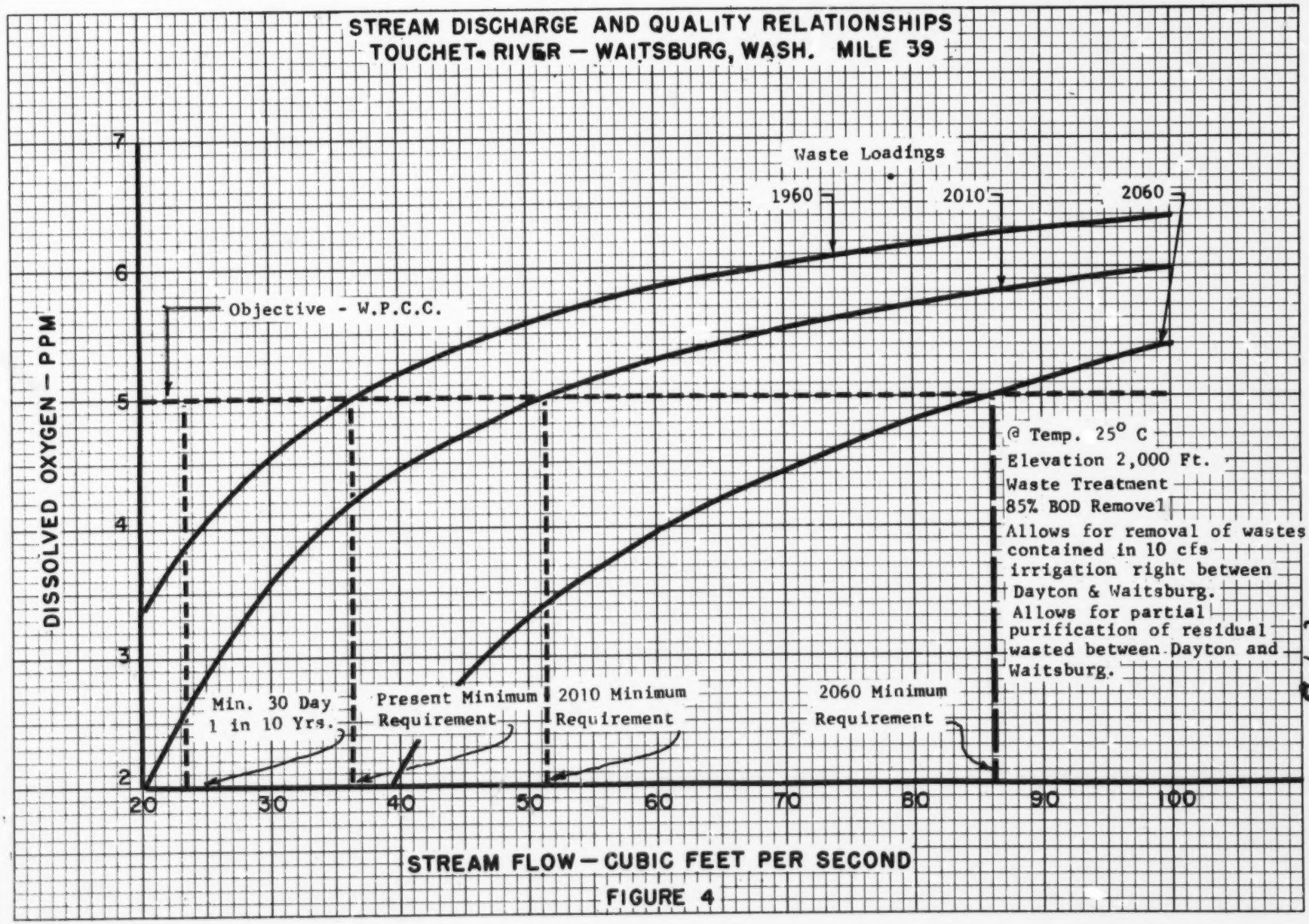

STREAM DISCHARGE AND QUALITY RELATIONSHIPS
TOUCHET RIVER — WAITSBURG, WASH. MILE 39
DISSOLVED OXYGEN — PPM
STREAM FLOW — CUBIC FEET PER SECOND
Waste Loadings
1960
2010
2060
Objective - W.P.C.C.
@ Temp. 25° C
Elevation 2,000 Ft.
Waste Treatment
85% BOD Removel
Allows for removal of wastes contained in 10 cfs irrigation right between Dayton & Waitsburg.
Allows for partial purification of residual wasted between Dayton and Waitsburg.
Min. 30 Day 1 in 10 Yrs.
Present Minimum Requirement
2010 Minimum Requirement
2060 Minimum Requirement
7
6
5
4
3
2
20
30
40
50
60
70
80
90
100

FIGURE 4

E-4-B

these effects cannot be made. Studies on the effects of irrigation return flows and possibilities for control are planned for conduct at later date. It should be understood, however, that the extent of regulation required to maintain suitable dissolved oxygen levels would provide, by means of dilution and increased assimilative capacity, significant control of the effects of land drainage as well as control of the effects of residual materials not removed from wastes by known conventional treatment means.

Figures 3 and 4 show the estimated rates of stream flow required to achieve control of various levels of dissolved oxygen throughout both the Dayton and Waitsburg reaches of the Touchet River for the years 1960, 2010, and 2060. Although rates of flow to achieve the minimum objective (5 parts per million of dissolved oxygen established by the Washington State Pollution Control Commission) are acceptable at the present time, a greater augmenting rate having significantly greater value for control of certain effects not now apparent, as for example, toxic and nutrient effects resulting from intensive irrigation, may at a later date, be determined.

As dilution flows in combination with waste treatment offer the only presently known means of achieving the prescribed quality objectives (distillation possible but more expensive and underground disposal would not be acceptable) benefits assignable to the Dayton reservoir for quality control by low flow augmentation would be equivalent to construction and operation costs involved in providing similar regulation by single-purpose means.

QUALITY CONTROL BENEFITS

Cost analyses have been made on two alternate single-purpose projects for quality control. One site is located on Wolf Creek above Dayton and the other at the proposed Dayton Dam site. Annual costs associated with releases involving 7,600 acre-feet of storage at these sites for quality control are shown below.(1)

Site Location	Annual Cost(2)
Wolf Creek	$ 94,600
East Fork (Bureau site)	111,600

(1) Prepared by Bureau of Reclamation
(2) Annual Equivalent Cost for Quality Control based upon 100-year analysis at 2½% interest.

By comparative costs it is apparent that the cost equivalent benefit assignable to provisions for quality control in the proposed Dayton reservoir would be $94,600 annually.

DISCUSSION

The protection of public health through the provision of a safe water supply has long been a matter of primary concern to the public health profession and has been a significant contributing factor to the high health standards of the Nation. However, the problem of providing adequate amounts of safe potable water has become increasingly difficult due to the pyramiding water demands of a rapidly expanding population. Furthermore, the resulting increase in waste flows has caused a gradual degradation in the quality of the Nation's waters. While improved methods of treatment and disinfection of both wastes and water have served to maintain the quality within tolerable limits, the progress in pollution abatement and water treatment has not kept pace with this population growth and industrial expansion.

The familiar problems of pollution by bacteria, organic matter, and chemicals of known toxicity and behavior have been further intensified and complicated by problems of mineral enrichment due to water reuse and by new types of contaminants associated with our chemical and atomic age. The effects of these newer contaminants on water treatment processes and on the human consumer are largely unknown. The deficiencies in knowledge and the prospect of even greater quantities of yet more complex pollutional materials reaching our surface waters emphasize the urgency of intelligent water quality management.

It is recognized that water for human consumption holds the highest priority of all water uses. The increased demands on quantity by an increasing variety of uses has also brought about many conflicts which can be solved only by intelligent and long-range management practices. Unfortunately, practically every water use results in some degradation of quality. As the supply becomes more critical and conflicts in use increase, water quality is assuming increasing importance.

Where alternate sources are available it is desirable to reserve the highest quality water available for domestic use and to satisfy other lower priority demands with waters of lesser quality. In areas of limited supply the ultimate water requirements can be met only by water reuse. Thus, dependence must be placed upon improved and more effective methods of water and waste treatment and other control methods in order to maintain the highest possible standards of quality for human consumption and other uses. However, in such instances every effort should still be made to reserve a sufficient quantity of high quality natural waters for domestic use before they flow on to supply other less critical demands.

It is sound planning to utilize highest quality water for highest priority uses, and the protection of this quality against irreversible and potentially hazardous degradation must be practiced to the fullest extent possible.

Because maintenance of a high level of water quality for all uses is basic to public health and the general well-being of the populations

and economy, planning for future water demand and uses requires the utmost of care. This is especially true when planning for needs many years in advance as is the objective of this evaluation.

Natural water quality is altered by man in many ways. Materials of certain types and quantities when disposed to stream water can unbalance the biological equilibrium, reduce recreational values, prevent use of the stream waters for municipal and industrial purposes, and create serious nuisance and public health hazards, all of which become liabilities to the area affected.

Because progress in pollution abatement and water treatment practices has not kept pace with population growth and industrial expansion, flow regulation as a supplement to conventional methods of abating pollution and controlling water quality possesses control value of particular significance.

Time has not permitted an analysis of improvements that could result from provisions for increased stream flow throughout the twenty-five mile reach of the Walla Walla River downstream from the mouth of the Touchet River. Since it is known that unsatisfactory conditions exist or can exist in this reach of the Walla Walla River, any regulation which would produce improvements in quality would possess benefits assignable to the regulating project. Furthermore, augmenting flow originating in the Touchet River Basin, even though perhaps small in relation to the total volume of the Columbia River, would possess value in terms of improved quality in downstream reaches of the Columbia River.

The quality objectives and related flow requirements recommended in this report are designed for achievement of the following purposes:

1. Prevent development of nuisance conditions;

2. Enhance the aesthetic and health values of the stream and adjacent areas;

3. Provide an environment suitable for propagation of resident and anadromous fish life;

4. Protect and enhance the natural self-purification capabilities and assets of the stream waters;

5. Reduce and neutralize the effect of residual fertilizers, weedicides, and insecticides.

The beneficiaries of water quality maintenance and values resulting from achievement of the above purposes are:

1. Land values--protection and enhancement;

2. Resident populations--health, social and economic improvement;

3. Livestock--health and well-being;

4. Natural resources--

   a. Fish and wildlife preservation;

   b. Preservation of the natural self-purification assets of the water resource;

5. Recreation--protection and enhancement;

6. Waste disposal--assimilative capacity (supplemental waste treatment).

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By virtue of the multiplicity of values (tangible and intangible) that are derived through maintenance of stream quality, the benefits attributable to provisions specifically designed for such maintenance may be regarded as "widespread."

Inasmuch as the water quality control program set forth in this report involves a reasonable degree of local participation in achieving the stated goals, it is believed of interest to the public that low flow augmentation as one of the requisites in achieving fulfillment of this goal be provided. Benefits attributable to provisions for water quality control where shown to be justified as a project function, therefore, are believed to be national in scope.

This working paper contains preliminary data and information primarily intended for internal use by the Columbia River Basin Project staff and cooperating agencies. The material presented in this paper has not been fully evaluated and should not be considered as final.